Modeling of drug resistance: comparison of two hypotheses on the example of LGGs

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Acquired drug resistance syndrome (ADR) is one of the most important features associated with tumour treatment and is therefore a topic of intensive studies. We present two simple mathematical models reflecting different mechanisms of ADR with some Darwinian effects included. These effects allow resistant cells to become sensitive again. One of our model is a modification of the model proposed by Ollier *et al.* [1] and the other is based on the ideas of Pérez-García *et al.* [2]. Basing on this mathematical approach we conclude that for constant continuous treatment, if no Darwinian effects are present, then once resistant cells appear, sensitive cells are eliminated after a long time, independently of the mechanism of acquiring the resistance. However, with Darwinian effects the situation is a little better as the sensitive cells are not completely eliminated but they are still outcompeted by the resistant ones. We discuss these mechanisms on the example of gliomas.

REFERENCE

[1] Ollier, E., Mazzocco, P., Ricard, D., Kaloshi, G., Idbaih, A., Alentorn, A., Psimaras, D., Honnorat, J., Delattre, J., Grenier, E., Ducray, F. and Samson, A., Analysis of temozolomide resistance in low-grade gliomas using a mechanistic mathematical model, Fundamental & Clinical Pharmacology, 31, 347–358, 2017.

[2] Pérez-García, V.M., Bogdańska, M., Martínez-González, A., Belmonte-Beitia, J., Schucht, P. and Pérez-Romasanta, L.A., Delay effects in the response of low-grade gliomas to radiotherapy: a mathematical model and its therapeutical implications, Mathematical Medicine and Biology: A Journal of the IMA, 32, 307–329, 2015.